CLAIMS

What is claimed is:

1.   A method for determining a logical path in a managed network between a source

2   device and a destination device at a data link layer, the method comprising the

3   computer-implemented steps of:

4   creating and storing a Connected Group Space representation of network devices

5   based on a topology space representation of the network devices;

6   identifying an optimized path in the Connected Group Space representation;

7   transforming the optimized path into the topology space representation; and

8   creating and storing the optimized path that was transformed into the topology space

9   representation as the data link layer path.

1   2.   The method as recited in Claim 1, wherein the managed network is a managed IP

2   network.

1   3.   The method as recited in Claim 1, wherein the step of creating and storing a

2   Connected Group Space representation further comprises the steps of:

3   identifying a set of Connected Group nodes associated with the Connected Group

4   Space representation;

5   identifying Connected Group links that connect the Connected Group nodes; and

6   creating and storing information that represents the Connected Group links.

1   4.   The method as recited in Claim 1, wherein the step of creating and storing a

2   Connected Group Space representation further comprises the steps of:

3   identifying a subnet associated with the source device and the destination device;

4   determining a set of network links that link one or more network devices in the

5   managed network; and

6   determining an assignment of ports of network devices.

1 5. The method as recited in Claim 1, wherein the step of creating and storing a

2   Connected Group Space representation further comprises the steps of:

3   identifying all Virtual Local Area Networks (VLANs) associated with a subnet

4   associated with the source device and the destination device; and

5   identifying all Emulated Local Area Networks (ELANs) associated with the subnet.

1 6. The method as recited in Claim 1, wherein the step of creating and storing a

2   Connected Group Space representation further comprises the steps of:

3   creating one Connected Group node for any pairs of interfaces across a point-to-point

4   link in the topology space representation;

5   creating one Connected Group node for any interfaces of the managed network that

6   are directly connected by virtue of being on a same physical medium;

7   creating one Connected Group node for LAN Emulation interfaces on a same

8   Emulated Local Area Network (ELAN);

9   creating one Connected Group node for each internal interface of any network device

10   when the network device has an internal interface;

11   creating one Connected Group node for the source device;

12   creating one Connected Group node for the destination device; and

13   creating one Connected Group node for each user interface on any network device

14   when the network device has a user interface.

1 7. The method as recited in Claim 6, further comprising the step of determining

2 Connected Group links between Connected Group nodes in a subnet associated with

3 the source device and the destination device.

1 8. The method as recited in Claim 7, further comprising the step of creating one

2 Connected Group link for each pair of interfaces within each network device, wherein

3 each interface is associated with the subnet of the source device and the destination

4 device and is in a forwarding state.

1 9. The method as recited in Claim 8, further comprising the step of checking a spanning

2 tree status for each interface within each network device to determine whether the

3 interface is in the forwarding state.

1 10. The method as recited in Claim 1, wherein the step of identifying an optimized path

2 in the Connected Group Space representation further comprises the step of finding a

3 shortest path between a Connected Group source node and a Connected Group

4 destination node.

1 11. The method as recited in Claim 10, further comprising the step of using a Dijkstra

2 algorithm to find the shortest path between the Connected Group source node and the

3 Connected Group destination node.

1 12. The method as recited in Claim 1, wherein the step of transforming the optimized

2 path into the topology space representation further comprises the steps of:

3 identifying an ordered set of Connected Group nodes associated with the optimized

4 path; and

5 identifying an ordered set of Connected Group links associated with the ordered set of

6 Connected Group nodes.

1 13. The method as recited in Claim 12, further comprising the steps of:

2 identifying a pair of interfaces associated with each Connected Group link in the

3 ordered set of Connected Group nodes associated with the optimized path; and

4 generating an ordered set of topology space links from the pairs of interfaces

5 associated with Connected Group links.

1 14. A computer-readable medium carrying one or more sequences of instructions for

2 determining a logical path in a managed network between a source device and a

3 destination device at a data link layer, wherein execution of the one or more

4 sequences of instructions by one or more processors causes the one or more

5 processors to perform the steps of:

6 creating and storing a Connected Group Space representation of network devices

7 based on a topology space representation of the network devices;

8 identifying an optimized path in the Connected Group Space representation;

9 transforming the optimized path into the topology space representation; and

10 creating and storing the optimized path that was transformed into the topology space

11 representation as the data link layer path.

1 15. The computer-readable medium as recited in Claim 14, wherein the managed network

2 is a managed IP network.

1 16. The computer-readable medium as recited in Claim 14, wherein the step of creating

2   and storing a Connected Group Space representation further comprises the steps of:

3   identifying a set of Connected Group nodes associated with the Connected Group

4   Space representation;

5   identifying Connected Group links that connect the Connected Group nodes; and

6   creating and storing information that represents the Connected Group links.

1 17. The computer-readable medium as recited in Claim 14, wherein the step of creating

2   and storing a Connected Group Space representation further comprises the steps of:

3   identifying a subnet associated with the source device and the destination device;

4   determining a set of network links that link one or more network devices in the

5   managed network; and

6   determining an assignment of ports of network devices.

1 18. The computer-readable medium as recited in Claim 14, wherein the step of creating

2   and storing a Connected Group Space representation further comprises the steps of:

3   identifying all Virtual Local Area Networks (VLANs) associated with a subnet

4   associated with the source device and the destination device; and

5   identifying all Emulated Local Area Networks (ELANs) associated with the subnet

6   associated with the source device and the destination device.

1 19. The computer-readable medium as recited in Claim 14, wherein the step of creating

2   and storing a Connected Group Space representation further comprises the steps of:

3   creating one Connected Group node for any pairs of interfaces across a point-to-point

4   link in the topology space representation;

5   creating one Connected Group node for any interfaces of the managed network that

6   are directly connected by virtue of being on a same physical medium;

7   creating one Connected Group node for LAN Emulation interfaces on a same

8   Emulated Local Area Network (ELAN);

9   creating one Connected Group node for each internal interface of any network device

10   when the network device has an internal interface;

11   creating one Connected Group node for the source device;

12   creating one Connected Group node for the destination device; and

13   creating one Connected Group node for each user interface on any network device

14   when the network device has a user interface.

1   20.   The computer-readable medium as recited in Claim 19, further comprising the step of

2   determining Connected Group links between Connected Group nodes in a subnet

3   associated with the source device and the destination device.

1   21.   The computer-readable medium as recited in Claim 20, further comprising the step of

2   creating one Connected Group link for each pair of interfaces within each network

3   device, wherein each interface is associated with the subnet of the source device and

4   the destination device, and is in a forwarding state.

1   22.   The computer-readable medium as recited in Claim 21, further comprising the step of

2   checking a spanning tree status for each interface within each network device to

3   determine whether the interface is in the forwarding state.

1   23.   The computer-readable medium as recited in Claim 14, wherein the step of

2   identifying an optimized path in the Connected Group Space representation further

3   comprises the step of finding a shortest path between a Connected Group source node

4   and a Connected Group destination node.

1   24.   The computer-readable medium as recited in Claim 23, further comprising the step of

2   using a Dijkstra algorithm to find the shortest path between the Connected Group

3   source node and the Connected Group destination node.

1   25.   The computer-readable medium as recited in Claim 14, wherein the step of

2   transforming the optimized path into the topology space representation further

3   comprises the steps of:

4   identifying an ordered set of Connected Group nodes associated with the optimized

5   path; and

6   identifying an ordered set of Connected Group links associated with the ordered set of

7   Connected Group nodes.

1   26.   The computer-readable medium as recited in Claim 25, further comprising the steps

2   of:

3   identifying a pair of interfaces associated with each Connected Group link in the

4   ordered set of Connected Group nodes associated with the optimized path; and

5   generating an ordered set of topology space links from the pairs of interfaces

6   associated with Connected Group links.

1   27.   A computer data signal embodied in a carrier wave, the computer data signal carrying

2   one or more sequences of instructions for determining a logical path in a managed

3   network between a source device and a destination device at a data link layer, wherein

4   execution of the one or more sequences of instructions by one or more processors

5   causes the one or more processors to perform the steps of:

6   creating and storing a Connected Group Space representation of network devices

7   based on a topology space representation of the network devices;

8   identifying an optimized path in the Connected Group Space representation;

9   transforming the optimized path into the topology space representation; and

10   creating and storing the optimized path that was transformed into the topology space

11   representation as the data link layer path.

1   28.   A computer apparatus comprising:

2   a processor; and

3   a memory coupled to the processor, the memory containing one or more sequences of

4   instructions for determining a logical path in a managed network between a

5   source device and a destination device at a data link layer, wherein execution

6   of the one or more sequences of instructions by the processor causes the

7   processor to perform the steps of:

8   creating and storing a Connected Group Space representation of network

9   devices based on a topology space representation of the network

10   devices;

11   identifying an optimized path in the Connected Group Space representation;

12   transforming the optimized path into the topology space representation; and

13   creating and storing the optimized path that was transformed into the topology

14   space representation as the data link layer path.